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ABSTRACT

This study examined the use of videotelephony by two men with moderate mental retardation attending a Swedish day center. This minitrial evaluated technical aspects of the equipment, understanding of how to use the videotelephones by people with moderate mental retardation, and general points of view from the staff. Both men had poorly developed spoken language skills using primarily augmentative and alternative communication. A system was designed based on a personal computer attached to a videotelephone, a camera, and appropriate software. Pictogram symbols were used to make communication simpler. Conclusions indicated: (1) the technical equipment must be improved, especially with regard to quality of sound and image, and the monitor must be improved; (2) the two users showed interest and motivation and used a variety of pictograms, but had difficulty accessing the right pictogram symbols; and (3) staff saw the videotelephony activity as time-consuming and expressed a need for deciding how much priority to give to the activity. (Contains 11 references, 2 in Swedish.) (DB)

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MINITRIAL

A limited study of the use of

Videotelephony for People with Moderate Mental Retardation

Jane Brodin, Maria Fahlén and Sven-Håkan Nilsson

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Department of Education, Stockholm University, S-106 91 Stockholm, Sweden. Tel +46 8 16 31 47. Fax +46 8 15 83 54

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Department of Education, Stockholm University, S-106 91 Stockholm, Sweden.
Tel +46 8 16 31 47. Fax +46 8 15 83 54

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Abstract:

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This report shows the results of a limited study with two participants. The study was conducted in order to evaluate the technical aspects, the user aspects and the staff aspects on videotelephony in the start-up process of RACE 2033, TeleCommunity. TeleCommunity is a European project within the telecommunication area and nine countries are involved in the experiments.

The report gives some ideas and experiences of the use of videotelephony for people with moderate mental retardation and may be a support when starting the main study. i.e. the Swedish ACE (Advanced Communication Experiments).

Keywords: videotelephony, mental retardation, telecommunication, minitrial

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Published reports.

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1988 RPH-Sär, Umeå, Sweden
1992 SIH Läromedel, Umeå, Sweden

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1. INTRODUCTION

1.1 Background

Most people consider it as a matter of course to be able to use telecommunications and regard it as impossible to live without a telephone. For people with mental retardation speech and communication is often difficult and complicated. Previous studies within the telecommunication area have primarily focused on individuals with visual impairment, hearing impairment, motor disability and elderly people. This study has focused on the use of videotelephony for people with moderate mental retardation.

Earlier studies on still picture telephones have shown that there are great benefits to be able to use telecommunications for people with moderate and profound mental retardation (Brodin & Björck-Åkesson, 1991, 1992). The participants in these projects were people with poorly developed spoken language or with non-verbal communication, i.e. they have no spoken language, but use gestures, body language, Pictogram symbols, sign communication (a simplification of deaf sign language) in their daily communication. The results showed that the still picture telephones facilitated communication. This conclusion was based on the facts that the still picture telephone gives both visual and auditory information at the same time, that the frequency of usage increased over time, that the motivation increased and that telephoning became gradually more independent. The pictures transmitted over the tele network also became more relevant and functional. These studies showed that the still picture telephone can contribute to increasing the possibilities for social contacts both with regard to quantity and quality.

Also other studies within this area have proved that picture telephones can be regarded as a good support in communication for people with different degrees of mental retardation (Brodin & Magnusson, 1992; Pereira, 1993; Pereira, Matos, Purificação & Lebre, 1991, 1992; von Tetzchner, Hesselberg & Langeland, 1991) and that the still picture telephones could be used in education and habilitation.

A study of telefax communication for people with moderate mental retardation (Brodin, 1993a) has also shown positive results. People who have never been able to communicate via an ordinary telephone have been able to send messages with Pictogram symbols to friends, parents and staff via telefax. The interest in communicating increased over time and the communication skills as well as the communicative competence were developed.

The experiences and knowledge gained from the above mentioned studies make the basis for the Swedish minitrial as well as for the ACE (Advanced

Communication Experiments) on videotelephones in RACE 2033, TeleCommunity. In Ireland, Norway, Portugal and Sweden minitrials with videotelephony for people with mental retardation have been carried out. This report contains the result from the Swedish minitrial.

1.2 Objectives of the study

The overall objectives of using videotelephony in the Swedish minitrial and ACE have been:

- to support and establish social relations and extend the social network
- to stimulate and encourage people to communicate more
- to facilitate, support and improve communication/interaction
- to have access to telecommunications in a "normal" way
- to support independent living
- to increase social integration

The objective of the minitrial has been to evaluate three main factors: the equipment *(technical aspects)*, possibilities to understand how to use the videotelephones for people with moderate mental retardation *(user aspects)* and general points of view from the staff *(aspects from staff)* regarding equipment, time consumption, training methods and so on. The results from the evaluation of the minitrial will be the basis for adapting the equipment for the main study.

1.3 Methods used in the evaluation of the minitrial

The evaluation of the Swedish minitrial has thus focused on *technical aspects*, *user aspects* and *aspects from staff*.

Table 1. Evaluation from three different aspects.

Equipment	User	Staff
size of screen	understanding of symbols	use of time
function of concept keyboard	user's attitude to equipment	number of staff
parts used in communication	reason for calling	education of staff
quality of image	conversation subjects	responsability for trials
quality of sound	way of communication	training methods
how to operate equipment (easy/difficult)	number of pictures sent	attitudes to the use (equipment, user)
quality of document camera	number of calls	
improvements	interest/motivation.	

The techniques used to collect the above data have been through questionnaires, ratings, observations and interviews. A careful background

description (Appendix 1) has been done for each of the two participants. This has been based on information collected in collaboration with parents, staff of group homes and day centers. The background information covers sex, age, housing conditions, educational background, disability, social network, leisure interests, use of technical aids, way of communication, cognitive level, earlier use of telephone etc. This part is showed as case histories of the two men involved.

Two forms, A-form (Appendix 2) and B-form (Appendix 3), have been worked out. The A-form has been completed by the staff at each telephone call and the B-form has been filled out by the staff at the day center after one week's and three week's use of the videotelephone equipment. Telephoning has taken place daily during the minitrial. As the minitrial has been effected with great care the experiences will probably contribute to avoiding difficulties and obstacles later on in the ACE. The results from the minitrial have been compiled and will be the basis for the evaluation of the Swedish ACE.

The selection of the day center has followed certain defined criterias e.g. continuity of staff, interest in technical aids, interest in learning new tasks, and possibilities to spend time on project work. The choice was Backen Day Center. The staff involved are occupational therapists and nursing staff. Two persons at the day center have been appointed to work with the task within their ordinary daily activities. The tasks have thus been part of the ordinary ADL-training.

Two men with moderate mental retardation have been included in the study. The selection of the participants has been effected by the staff of the day center in cooperation with the project leader according to defined criterias, e.g. interest in communication, motivation to learn new tasks, physical possibilites to operate the equipment, a defined need for communication support. The participants use graphic symbols, sign communication, gestures, facial expressions and sound. The spoken language is poorly developed. The aim of the training has been to improve the ability to communicate.

The Swedish minitrial has been based on person-to-person communication and have included participant-staff and participant-participant communication. When the term participant is used, it should be understood as the person with mental retardation. The subjects in the Swedish minitrial and ACE are people with moderate mental retardation. Many different terms are today used to describe mental retardation e.g. mental/intellectual disability, mental/intellectual impairment, mental/ intellectual handicap, developmental disorder/disturbance or intellectual retardation/delay. Sometimes the term slow learners or people with difficulties in reading and writing are categorized as intellectually handicapped and included in this population. Different terms are used in

different parts of the world and by different categories of professionals. In order to avoid this group of people being mixed up with people with mental illness, which is often the case nowadays, the term mental retardation can be used. Definitions are intended to be tools to facilitate understanding between human beings in order to avoid complications due to language differences as well as cultural and social factors.

The Swedish evaluation has been quantitative as well as qualitative. The techniques used are questionnaires, ratings, observations and interviews. The use and the function of the equipment have been evaluated continously. Due to the intellectual disabilities of the participants in this study the support can be described as support for communication/ interaction and social integration.

The *quality of effect* has been considered to be one of the most interesting and important parts of the Swedish minitrial and will show the personal impact with regard to certain factors as possibilities to operate the equipment, to compensate for the disability as well as the functional competence. The effects will be based on *background information, questionnaires, telephone protocols at each call, observations and interviews*. The following aspects have been covered in the evaluation:

Communication/interaction and social integration
changes in communication (in general, in other situations)
changes in mood, motivation
changes in degree of activity
changes in communicative behaviour (turn-taking, initiatives)
changes in communicative competence (communications skills)
changes in independence
changes in the way to communicate (picture, sign, gesture, speech)
changes in social skills
changes in social interaction (cooperation with staff, peers)
changes in social network

Communicative competence means to function adequate in daily life. Communicative competence can be assessed with regard to linguistic, functional, social (socio-relational) and structural aspects (Brodin, 1993b; Björck-Åkesson, Brodin, Granlund & Olsson, 1992; Light, 1989).

Many people with mental retardation have difficulties to show their communicative competence in order to make people in the environment understand what they mean. They need a lot of support and training to learn to communicate efficiently. The main aim is to offer opportunitities for people with mental retardation to function in society at the same conditions as all other citizens. The "service" offered is therefore accessibility to existing services in the Swedish community.

2. DESCRIPTION OF THE TECHNICAL EQUIPMENT

2.1 System introduction.

The aim has been to design a videotelephone which can be handled by mentally retarded users. The list of the equipment can be found in Appendix 4. The base is an IBM compatible PC equipped with additional serial communication ports. The videotelephone software is designed for a Windows environment. The public ISDN is used for connections between the videotelephones. A standard H.261 codec is used. The functional block diagram is showed in Figure 1.

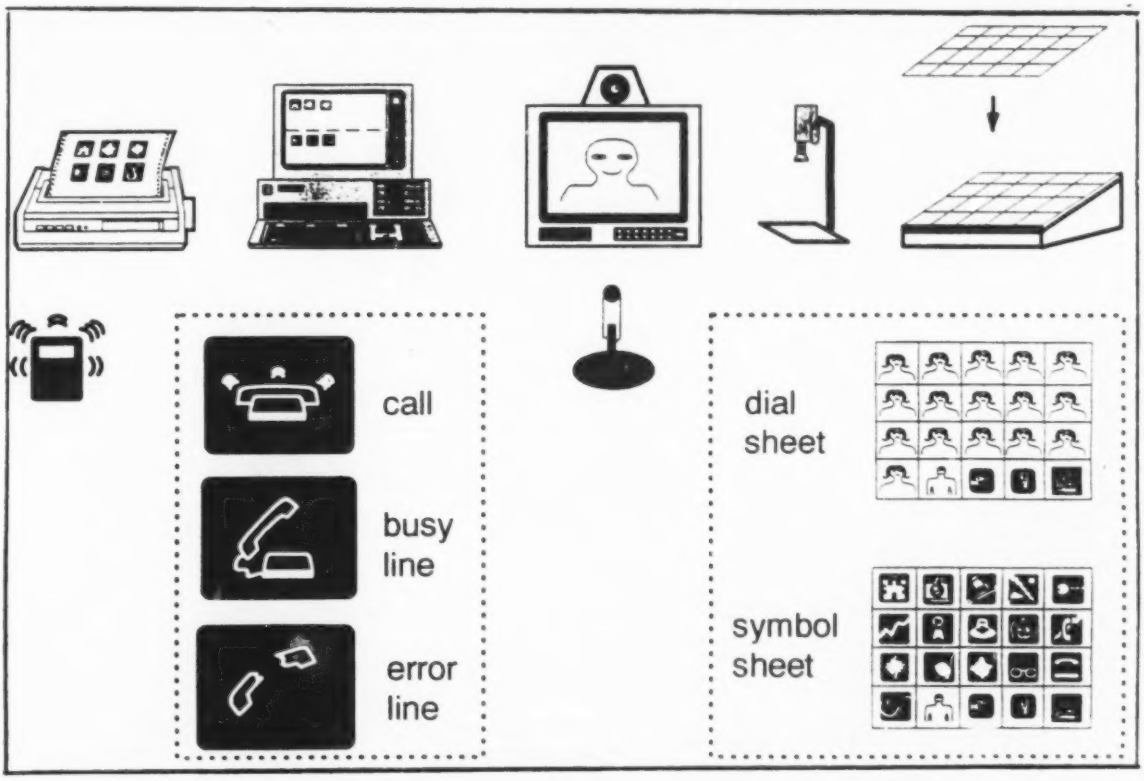

Figure 1. Functional block diagram

The user interface is a 14" VGA colour screen, and a modified concept keyboard with a built-in optical sheet detecting facility. The VGA screen shows the Pictogram symbols received and transmitted during the call. The television monitor normally shows the far end picture. The concept keyboard is used for commencing and ending calls as well as for symbol communication. Pictogram symbols are used to support the spoken language. This graphic symbol system is widely spread among mentally retarded people, with about 600 different symbols available.

Additional video equipment includes an RGB camera placed on top of the television monitor and a document camera with a built-in camera switch, which automatically selects the picture from the document camera when there is a document or another object present in front of that camera. The audio equipment is a microphone with amplifier and the loudspeaker in the television monitor. A laser printer is included for printing the pictogram symbols transferred during a call. For the awareness of incoming calls a paging system is used. Every user is equipped with a tactile receiver.

2.2 Equipment

The aim has been to design a videophone with a user-friendly man-machine interface. A standard *concept keyboard* is the base. A concept keyboard consists of a flat membrane keyboard in ordinary A3-format. The pressure-sensitive area is divided into 128 squares, 8 rows and 16 columns.

Some modifications have been made to the standard concept keyboard. A V.24/V.28-port connects the keyboard to the PC, to indicate which keypad that has been pressed. The user puts a symbol sheet, with 32 symbol squares, on the flat keyboard. The symbols on the symbol sheet cover, if correctly placed, the 128 keyboard squares. Every symbol square on the sheet covers 4 squares on the keyboard. Thus, the user can press a symbol square on the sheet and the computer will get information about this. To separate the different user symbol sheets from each other an optical sheet detector has been designed for use with the concept keyboard. Every sheet is marked with a unique digital code, consisting of 8 filled or unfilled circles. Reflex detectors, placed in the keyboard housing, are used to read this code. When no symbol sheet is applied or when the sheet is not properly placed a LED on the keyboard is flashing to notify the user. For better support to users with motor disabilities a mechanical redesign has been made. The flat keyboard is leaning towards the user. The front and the right hand side of the keyboard has borders to make it easy to put the symbol sheet in its proper place.

There are two categories of symbol sheets. The dialling sheet has photos of the persons that the user might want to call. A call is initiated by pressing a photo square. The pictogram sheet has pictograms in the symbol squares. During a call a pictogram is sent to the two screens involved when a pictogram square is pressed. Both types of sheets has a square for removing the last pictogram transmitted and another for ending the call, as well as squares for obtaining a self-view on the television monitor and for returning to the far end picture. A call is also disconnected if no symbol sheet is applied on the keyboard for more than 30 seconds or if a call goes on for 30 minutes without any symbols being

pressed. To answer an incoming call, a symbol sheet is placed on the keyboard or, if a sheet is already present at the keyboard, a symbol square is pressed.

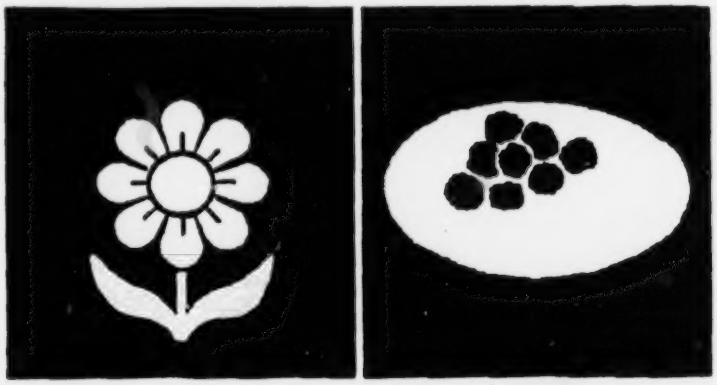

Figure 2. Pictogram pictures of flower and meatballs

The PC used is an IBM-compatible PC 386SX/33 MHz, equipped with 4 Mbyte RAM, a 120 Mbyte hard disc and Windows 3.1. The minitrial equipment has *two monitors, a 14" computer colour monitor for the pictogram symbols and an ordinary colour television monitor* for the far end picture. A self view could be obtained by pressing a button on the concept keyboard.

The *14" VGA computer screen* shows the received Pictogram symbols on the upper half of the screen on a red background and the sent Pictograms on the lower part on a green background. Figure 3 shows the screen disposition. The far end picture is shown at the television monitor.

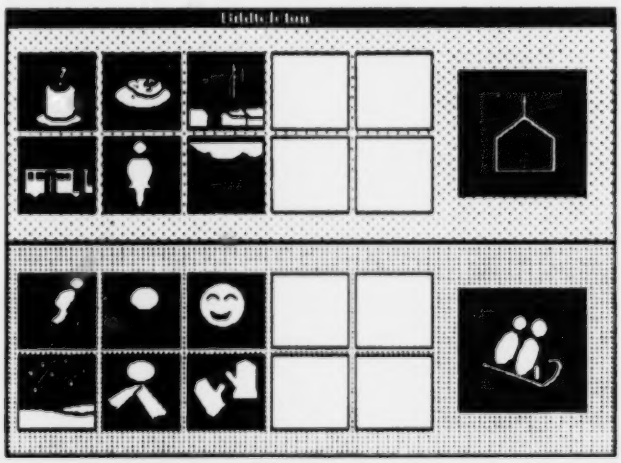

Figure 3. The screen disposition

The *codec* used is a Tandberg Vision Model 15. The reasons for working with Tandberg Vision during the minitrial was that the Vision offers a data channel together with video and audio transmission. This function is vital for the pictograms and for paging information. Vision was also approved for use in the Swedish ISDN network. During the minitrial the Vision, with Tandberg software version H installed, has behaved reasonably well. The Hayes-like command interface, included in the H software release, is used for dialling. The codec keyboard interface is used for all other control functions.

The *audio equipment* consists of a table-placed microphone and the loudspeaker in the television monitor.

The *main camera* is placed on top of the 20" monitor. It does not have a zooming function. The focus is settled at installation, and the user can adjust his/her distance to the screen supported by the self view.

The *document camera* is specially designed. It includes an automatic video switch. When the user puts a document or any other object in front of the camera the switch selects the document camera picture for transmission until the object is removed. This procedure can be followed on the screen in the permanent self view window. The camera used is an industrial type of CCD-camera.

To make a user aware of an incoming call a *paging system* is used. When connection is established between two video phones a paging command is sent from the originating phone. This command includes information about the number of the receiver carried by the answering person. The answering video phone requests a paging for that person whose receiver beeps or vibrates. The Swedish Telecom "Minicall" service is used. This requires a modem and a telephone line which are used to call the "Minicall" computer to initiate the paging. The time that elapses between the connection of the videotelephones and the actual activation of the called person's tactile receiver is 30-60 seconds.

When a call is finished the pictogram symbols used during the call are printed out on paper. An ordinary 300 dpi *laser printer* is used to get a reasonable speed, which is considered to be a few minutes. The received and transmitted symbols are printed on different sheets. If many symbols have been used several sheets are produced. The sheets can be used to remember what topics where covered and referred to in future calls by use of the document camera.

2.3 Network, specifications and installation

The videotelephony service is utilising the Swedish ISDN network. The basic access rate interface with the two 64 kbit/s-channels is used for codec video and audio signals. The D-channel signalling includes inter-terminal communication with end subscriber code, graphic symbol code and statistical data.

The Swedish ISDN network was introduced as a public service in April 1993. A majority of the population will have the possibility to be connected to the network. The present restriction for subscription is a limitation of 5 km at range from the exchange or multiplexor. However, a lot of research is currently going on with the aim to extend the subscriber connection range. An adaptation to Euro-ISDN is expected to be completed in 1994.

3. PARTICIPANTS IN THE MINITRIAL - BACKGROUND INFORMATION

The participants in the minitrial are two men, Daniel (32 years old) and Tom (35 years old) both with moderate mental retardation. They live in different group homes and spend their days at Backen Day Center. The background information have been collected in a questionnaire filled out by the staff from the group homes and from the day center. In the first phase the staff picked out the 50 most frequently used Pictograms for the two participants to be used on the concept keyboard. Daniel has earlier participated in a project with still picture telephones and changes in his behaviour and development have been noted with regard to motivation and interest in communication.

3.1 Daniel

Daniel is 32 years old. He used to live together with his parents until he was 12 years old, when he moved to an institution for children with mental retardation. After a year he moved to a nursing home and after another year to a second nursing home. He lived there for eight years until he moved to a group home at the age of 22. Since ten years Daniel lives in a group home with four other adults. He spends his leisure time watching TV, listening to music, going to dances and parties, playing bowling, swimming, and relaxing. Daniel has spent about 14 years in a school class for children with severe mental retardation.

Daniel goes to the day centre by bus and he is attending a group for physical activities and adult education once a week. Twice a week he

participates in a communication group where they prepare a newsletter with pictures. This group is also responsible for transferring written information into pictures giving service to other groups with picture material. Daily he is engaged as "postman" at the day center.

Social network
Daniel's mother is dead since a couple of years. She used to be his closest relation. His father is old and Daniel has only sporadic contact with him. He also has sporadic contact with his sister. She has become more positive to Daniel and the contact has increased since the mother died. His father has a new wife and Daniel has also sporadic contact with her and with a good friend of his father. The family is very important to Daniel and he often talks about them.

Daniel has every day contact with a man who is working at the group home. He has just returned to work from a prolonged illness. Every week he has contact with a neighbour, who is also mentally retarded and one of the staff from the day center, to whom he calls in the evenings. A new person will be introduced to him for the leisure time. He also has daily contact with staff from the day center, group home and friends living in the same group home. Daniel has no contact person, which is a legal right for people with mental retardation.

Functional disorders
At birth it was evident that Daniel has Down's syndrom. He was assessed and diagnosed by a doctor and a psychologist within the service system for mentally retarded persons in 1964 and 1969, at the age of 6 and 9. The staff at the day center and group home regard him as moderately mentally retarded. Daniel has a visual impairment, reduced hearing perception, speech and communication difficulties, diabetes and food allergy. He uses spectacles. His gross and fine motor abilities are good, but he has some difficulties with coordination.

Pictures/communication/language
Daniel recognizes objects and persons on pictures and photos. He also recognizes Pictograms, and symbols are used for communication or for marking objects and places in his near environment. He cannot read digits or letters, but he recognizes the letter group forming his name. Daniel is motivated to commmunication and uses speech. His speech is however, sometimes difficult to understand and he often misunderstands or does not always understand what people say. He reinforces his speech with gestures, pictures, signs and concrete actions. He often initiates communication and he always responds. The communication aids used are Pictograms, Picture Communication, diary, day schedule, stamp with his own name, still picture telephone, automatic dialler and photos. When he is busy as a postman he has photos of the receivers instead of their written names.

Daniel has participated and completed other projects directed towards communication and he still uses the communication aid. Daniel has improved his communicative ability since he first went into the telecommunication project. Earlier he seldom used the telephone. Today he uses the still picture telephone daily and he can make the call by himself. He can answer the telephone and he recognizes voices.

At home, he uses his loudspeaking telephone. He presses the button for automatic dialling and can also manage to complete the call. He can effect his telephoning independently. When he uses an ordinary telephone he asks the staff for help to dial the number.

3.2 Tom

Tom is 35 years old. He has lived most of his life in different institutions and spent shorter periods in between in family homes. Since 1985 he lives in a group home. He is interested in listening to music, going to concert halls, visiting cafés and going to the cinema. Tom has spent 12 years in a school class for children with severe mental retardation. He left school in 1981 and started to work at the day center.

Tom's daily activity is to be a postman together with Daniel. He also works in a communication group where they give service to the other persons at the day center.

Social network
Tom has no contact with his mother, father or siblings. He has no contact with his relatives or friends outside the day center and the group home. The only person he meets continously, i.e. every week is his contact person. To have a contact person is a legal right for people with mental retardation in Sweden.

Functional disorders
Tom has Downs syndrom and he is assessed to be at the B-level (Kylén, 1981). This means that he is moderately mentally retarded. He has been tested in 1964 with two different tests: Merrill-Palmer test and the Vineland Interview.

Tom has normal vision and hearing but he has a motor disability. He has difficulties to walk due to stiff hips. He is not in need of mobility aids but his gross motor ability is reduced. Tom has also a heart disease. He has speech and communication disorders.

Pictures/communication/language
Tom recognizes objects and persons on pictures and photos. He also recognizes Pictograms, and symbols for communication or for marking

objects and places in his near environment. He cannot read digits or letters. Tom is motivated to communication and uses speech with single words. He cannot communicate with whole sentences. Tom mainly uses sign communication, speech, gestures and sounds for communication. The communication aids used are Pictograms, Picture Communication, photos, diary, schedule, Pictogram stamps, still picture telephone and loud-speeking telephone. Tom often initiates and responds to communication. He has never participated in a project directed to communication before.

Tom calls his contact person using a telephone with a loudspeaking unit. He also calls the day center and uses a still picture telephone and a loudspeaking telephone. Tom received a still picture telephone of his own in December 1992, but before that he had only used the still picture telephone in the day center.

Tom recognizes voices and he can make calls with the help of an automatic dialler, but he cannot answer the telephone. Tom does not take any initiatives but is interested in telephoning if he is asked to. He presses the buttons, he knows how to use the loudspeaking telephone but he needs help to show the pictures to be sent via the still picture telepone.

4. PREPARATION AND START OF THE MINITRIAL

4.1 Selection of Pictogram Pictures

For each participant the 50 most frequently used Pictograms have been selected. The choice was done by the staff at the day center and gives a good picture of what the participants are interested in. It also gives an idea of what topics would be possible to talk about using Pictogram pictures and the concept keyboard. Of course, it is a limitation that only 50 Pictograms can be used in the evaluation for each participant, but in the ACE the number of pictures will be extended. However, the participants can use other Pictograms, but not together with the keyboard. They can show the Pictograms on the document camera or just hold them up in front of the videophone. The symbols used for the concept keyboard can be seen in Table 2 and Table 3 below.

The list of the Pictograms for each participant are presented on the next two pages. However, some of these Pictograms were not used but changed as the staff after a little while noted that they were not useful. The Pictograms marked with an * were excluded and new added instead.

Table 2. *Daniel's Pictograms. (N = 50)*

A People	4	man *	**D Inventories**	5	book
	5	woman *		15	letter
	9	father		29	radio
	10	mother		34	telephone
	11	friends		35	TV
	12	group*		42	computer
G Food	1	meetballs	**L Garden**	2	flower
	5	coffee			
	9	hamburger	**M Weather**	1	day/sun *
	10	hot dogs		4	rain
	18	sandwich		6	snow *
	19	soup	**N Music**	2	guitar
	21	chicken			
	26	ice cream	**O Leisure**	12	pop group
	27	cake		24	newspaper
	28	pie			
			R Transports	5	bus
P Feelings	2	happy		15	taxi
	6	angry		16	train
S Localities	8	church	**T Activities**	12	dance
	9	city		28	visitor
	21	shop		44	rest
	22	restaurant		59	walk, going places
	25	home		71	stick together
	28	day center			
			V Qualitites	16	ill/pain
U Feasts	1	Christmas			
	2	Easter	**Z Diverse**	25	Pictogram
	4	party			

*** excluced from the list just before preparation of the concept keyboard**

New Pictogram symbols added:

clothes	**C36**
weep	**T67**
bowling	**O2**
insulin shot	**Z4.**
draw	**T14**
visitor	**T28**

Five Pictograms were excluced and six new were added to the concept keyboard.

Table 3. *Tom's Pictograms (N=50)*

A People	4	man *	**D Inventories**	5	book
	5	woman *		15	letter
	11	friends		29	radio
	12	group *		24	telephone
				35	TV
G Food	1	meetballs		41	sewing machine
	5	coffee			
	7	food	**M Weather**	1	day/sun *
	8	pommes fries		4	rain *
	9	hamburger		6	snow *
	12	meet			
	13	pancake	**N Music**	1	drum
	27	cake			
	32	chips	**O Leisure**	6	icehochey
	39	spaghetti		11	break *
	41	yoghurt		12	popgroup
	43	drink *			
P Feelings	2	happy	**Q Professions**	1	dentist
	6	angry		2	doctor
			S Localities	9	city
R Transports	1	aeroplane		21	shop
	5	bus		22	restaurant
	15	taxi		25	home
T Activities	12	dance	**U Feasts**	1	Christmas
	25	drink *		2	Easter *
	28	vistors		4	party
	44	rest			
	59	walk, going places *	**Z Diverse**	25	Pictogram
	71	stick together			

*** excluced from the list just before preparation of the concept keyboard**

New Pictogram symbols added:

work	**A163**	**wheelchair**	**G148**
clothes	**C36**	**park**	**S17**
stationaries	**D24**	**day center**	**S28**
computer	**D42**	**draw**	**T14**
lemonade	**G29**	**cry**	**T67**
dog	**J5**	**Lucia**	**U5**

Eleven Pictogram symbols were excluded and twelve new were added to the concept keyboard

4.2 Starting point of project - installation of equipment

The equipment was developed, adapted and tested at Daltek Inc, Borlänge. It was first installed on October 21st and 22nd 1992, but during the first week the videotelephones did not function as expected.

Daniel made a telephone call in the very start, but it did not turn out satisfactory. He was bored and wanted to quit the dialling. He said: "I don't want to use this - I want to use my still picture telephone instead". He feels safe and has a basic trust when using the still picture telephone and he knows how to operate it. This new videotelephone made him feel uncomfortable and worried especially as it did not function well. He felt unsafe in this new situation.

Unfortunately, the staff made a mistake when they let him try the equipment before they were sure that it was functioning. They had been told that the two persons with mental retardation were not allowed to use the equipment until the staff had learnt exactly how to run it. This was based on earlier project experiences. If you let a person with mental retardation use a technical device and the staff is not familiar with the equipment they cannot give a good enough support. This may influence the whole project in a negative way. Daniel may loose his motivation and a lot of time will be spent to build up his expectations of the videotelephony.

Technical problems reported during the first week of use.

1. There was an echo on the telephone lines and the calls were often interrupted.
2. The quality of the picture was sometimes poor. There were dots on the image depending on network or codecs.
3. It was difficult to put the overlays correctly on the concept keyboard, especially for Tom.

4.3 Plan for the execution.

Week for staff preparation (44)
Before the preparation week the staff filled out a form including background information about the two participants. It contained information about age, living conditions, educational background, social network, leisure activities, degree of mental retardation, diagnosed by whom and how, i.e. what kind of tests were used. The questionnaire also contained information about additional disabilities, ability and ways to communicate, ability to use a telephone and if they had participated in similar projects earlier. The background information gave a good idea of what could be expected from the two participants and about their possibilities to use the videotelephone.

During the preparation week the staff involved in any part of the minitrial had to learn how the videotelephones function. They had to practice all moments in order to learn as much as possible before the two men, Daniel and Tom started their use of the videotelephones. These demands are necessary as it is impossible to teach somebody to do something you don't master yourself.

The first week with the participants. (45)
Daniel and Tom started to use the videotelephones. This was their first week in the project. The staff filled out a telephone protocol at every call. Each of the two men had to make at least one telephone call a day. After the first week with Daniel and Tom, the staff had to fill out a form about the equipment (questions related to technical outfits etc), their working situation, time consumption and many other things. The same form was completed after the videotelephones had been used for three weeks. It was then possible to compare the results in order to find out how many of the problems reported at the start still existed after three weeks use.

The second, third and fourth weeks (46 , 47, 48)
Ordinary calls with completion of the telephone protocol was conducted. After the third week the B-form was filled out again.

The fifth and sixth weeks. (49 and 50)
A report with the results was planned to be completed.

4.4 Conduction of the plan

The plan was not completed in due time due to technical problems. The real evaluation started on January 11th 1993 and the empirical study was completed at the end of February. The data collection was finished on March 5th, almost 12 weeks later than planned.

The final and adapted equipment for the ACE will according to the project plan be ready at the end of May. The installation at the six day centers will start in June and the Swedish ACE will start in September after the summer vacations. The process to select day centers for the ACE has started and will be finished in the middle of May.

5. RESULTS

5.1 General results from the first three weeks

The results from the B-form, which was filled out after one and after three weeks' use, show that no significant changes have appeared over time.

It has been difficult for the participants to understand when to answer the videotelephone, i.e. when the telephone call is connected. The paging system, the personal minicallers, have not been used as the staff found it too complicated for the participants at the start. The equipment will be changed in different ways e.g. one monitor will be used instead of two. This was already planned at the start. The following points of view have appeared when interviewing the staff:

- The staff stress that the *size of the monitor* is too small. It has been difficult to see if someone is signing "too" low. i.e. with his hands on his knees. Tom usually signs at the height of his waist and Daniel has not conceived that Tom is signing. It has also been difficult for the participants to understand that the communication partner can see the sender all the time and to explain that pictures sent via the document camera can be seen on the monitor of the partner. It has also been difficult to understand and to explain for the participant that objects must be removed from the document camera in order to send new pictures. It seems to be easy to end up outside the monitor e.g. to sit in an angle where the camera cannot zoom in the participant.

  Due to the visual impairment of the participants the staff stress that the screen of the monitor must be larger. The staff also require one monitor instead of two. This wish will be met in the ACE.

- The *concept keyboard* has not functioned acceptably. There has been difficulties to change the pictorial sheets and to understand how to put them correctly on the concept keyboard. It does not seem to be natural for Daniel e.g. to use the concept keyboard and this must be trained.

- When there is a call a picture is shown on the monitor *symbolizing a "calling telephone"*. First of all the participants do not notice the picture on the monitor and the staff has to draw the attention to the picture and tell what is going on e.g. that it sounds like a telephone call.

- With regard to the time used the staff point out that it is important that the videotelephoning is *on the schedule*. Nobody has yet taken any initiatives of their own to make a call.

- With regard to *staff involvement and responsibility* in the activity the staff report that during the first week three persons from the staff were involved in the videotelephoning, the third week four persons were involved. Two persons of the staff have been responsible for the project activity and for the training of the two participants. The staff have also spent "a lot of time" to plan the activity and to learn how the equipment functioned.

- The staff have spent *time* daily during the first two weeks to learn how to run the equipment. Every week about three hours have been spent on preparation and conducting the calls. (Time for own learning of the equipment is not included). The staff report that they have experienced the work as interesting, positive, but time consuming. They stress that the participants need a lot of training in order to learn to use the videotelephone and to understand how to benefit from it.

No changes in staff attitudes, after finishing the minitrial, towards the use of the videotelephones have been found, despite all complications. The participants are still positive to use the videotelephones according to interviews with the staff.

5.2 Results from the minitrial

A total of 40 telephone calls have been registered. Daniel and Tom have made 20 calls each. They have called each other, but during the last week the telephone calls were completed between the participants and one of the staff. A total of 28 calls were conducted between participant and participant, and 12 were conducted between participant and staff. In all cases the staff has taken the initiatives to call and the reason for calling has been to test the equipment (38). In two cases the reason "for training" has been indicated. The minitrial went on for six weeks.

The personal minicaller has not been used in the minitrial, which means that only five different parts of the technical equipment have been evaluated. The equipment consists of videomonitor, Pictogram monitor, document camera, printer and concept keyboard. In 36 cases all parts have been used during the telephone calls. In two cases the document camera was excluded and in two cases the printer.

Technical aspects of the equipment
The technical aspects of the equipment has focused on quality of image, quality of sound, function of the document camera and function of the concept keyboard.

Table 4. Quality of image and sound

Marks	Quality of image	Quality of sound
Very good	1	1
Good	8	13
Satisfying	10	14
Poor	15	7
Very poor	6	4
No answer		1
	40	40

The results show that the quality of the image has been satisfying in 10 cases, but poor and very poor in 21 cases. Only in eight cases has the quality been good, and in one case very good. This shows that the quality of the image must be improved.

The quality of sound is satisfying in 14 cases, good in 13 cases and very good in one case. The quality of sound has been poor or very poor in 11 cases. In one case there was no reply to the question. This shows that the quality of sound seems to be better than the quality of image, but both must be improved.

To the question if the participants experienced difficulties to place the pictures or objects correctly on the document camera 28 answered yes, seven answered no and five answered sometimes or gave no answer. It seems to be difficult to understand that the dialogue partner can see the picture of the objects transmitted via the document camera. There has also been difficulties for the participants to understand that the objects on the document camera must be removed in order to transmit other pictures. At an early stage the staff found the document camera a problem and wanted to exclude it. At the end of the project they found the document camera useful.

To the question if the participants experienced difficulties to put on and change the overlays on the concept keyboard during the telephone calls 23 answered yes, nine no and eight sometimes or gave no answer. The participants have had difficulties to place the sheets with the Pictograms correctly on the keyboard, but there is a small change over time which could be the result of training/learning. There is a technical problem which cannot be denied, but also a pedagogical. With adequate training the participants will probably learn to place the Pictogram sheets more carefully on the concept keyboard.

Frequency of use

The frequency of use show how many pictures have been sent via the concept keyboard, the document camera and the videotelephone.

Table 5. Frequency of use

Equipment used to send pictures	Number of pictures
Pictures sent via the concept keyboard	243
Pictures sent via the document camera	105
Pictures sent via the videotelephone	57
Total	405

Most pictures were transmitted via the concept keyboard (243). One reason for this is probably that the Pictogram pictures have been easy to find on the keyboard. The participants have used the document camera 105 times but it has been difficult for the staff to explain that the picture or object on the document camera will be transmitted to the receiver. There is an increase in number of pictures sent via the document camera and via the concept keyboard in the participant-staff dialogues. This is especially significant for Daniel. Once when Daniel was eating an apple he put his apple on the document camera to show one of the staff what he was eating. This was done on his own initiative.

The most frequently used topics for communication have been activities, food and feelings. The two participants have told each other what they have done, what they are doing and what they plan to do later. When they talk about food they inform each other what they have eaten, what they are going to eat and what they are fond of. The Pictograms for coffee and hamburgers are often used and seem to be popular to talk about. In connection with food they also talk about the insulin shot Daniel has to take. They often tell each other if they are happy or feel angry with something.

The 50 most frequently used Pictogram pictures had been selected for each of the two participants at the starting-up process of the minitrial. However, some Pictograms have not been used by Daniel nor Tom. These are: radio, dentist, stick together and Christmas. Other pictures which are specific for one of the participants and have not been used are e.g. train, aeroplane, sewing machine.

Pictogram pictures which have not been included in the minitrial and for which there has been a need are e.g. postman and hospital. Unfortunately, a change of Pictograms were made at the start and before preparation of the concept keyboardwithout informing the project leader. However, it is extremely difficult to pick out the 50 most frequently used Pictograms. From the start Tom did not have the symbol for wheelchair and this symbol became very important for him. Tom has a friend for whom he cares a lot. She fell and broke her leg and she had to go to hospital. She also had to sit in a wheelchair. Tom has been very worried about her and talked a lot about the hospital, about Mrs Andersson's leg (he always calls her by her family name) and about the wheelchair. Tom has talked about the wheelchair ten times and about his desire to stay at home from the day center and do other things than work nine times.

Hospital has also played an important role for Daniel as he is suffering from diabetes and sometimes needs to go to the hospital as he does not feel well. He also has to take insulin shots every day, so of course the picture of an injection was needed for his use. Daniel has talked about the injection 17 times. He has talked about drinking coffee 11 times, about staying at home from the day center 11 times and that he feels sad seven times. As Daniel and Tom are responsible for the internal distribution of mail the Pictogram for postman would have been useful. However, it seems to be difficult to chose the "right" symbols as the interest of the participants change over time and from time to time.

User aspects

One question was about the participant's attitude to use the videotelephone. The results can be found in the table below.

Table. 6. Participant's attitude to use the videotelephone

Expression	Number of marks	Positive or negative
Looks happy/seems to enjoy	17	+
Seems motivated	20	+
Takes initiatives	19	+
Shows expectation/excitement (activity)	16	+
Shows interest	22	+
Shows no interest/looks bored	9	-
Looks afraid/looks anxious	0	-
Looks angry/upset	1	-
Task is difficult/laborious	0	-
Seems unconcerned	2	-
Other	1	

The above table shows that most of the marks are on the positive part of the scale. This means that the participants have been interested, motivated, have taken initiatives within the communicative interaction, looked happy and have seemed to enjoy the actitivity. It also shows that they show expectation and are excited to make the calls.

With regard to the way to communicate, the participants have used total communication which means that they have mixed many different ways at the same time. For Daniel the spoken language and the Pictogram symbols have been the main way to communicate and for Tom the Pictogram symbols and the signing have been the main way.

Points of view from the staff

The staff from the day center have been positive and interested in using the videotelephones. The technical problems at the start have probably to some extent influenced their attitudes to the videotelephones in a negative way, but they tried very hard to get the equipment to function.

The work with the videotelephones has been time consuming, but as they had put it on the schedule already from the start it was part of their ordinary job. They gave the activity high priority. They spent about three hours every week to make the telephone calls.

CONCLUSIONS

The ambitious project plan was impossible to follow as we had trouble with the technical equipment. The starting point of the minitrial had to be postponed about 12 weeks. The minitrial started on the 11th of January with staff training, and on the 18th of January the two participants started the experiment.

The main activity at Backen day center is augmentative and alternative communication training and the staff have long experiences and good knowledge of this kind of tasks. The staff are well educated in this area and know the participants well. Although the minitrial has been time-consuming, the staff have been interested and positive to conduct the study.

The minitrial has been effected with only two participants and the focus has been on the technical equipment, user aspects and staff aspects. The experiences may contribute to avoid some mistakes in the main study, e.g. in the ACE.

Technical equipment
The aspects of the technical equipment are based on information collected from the evaluation forms A and B as well as interviews with the staff. The results show that the technical equipment must be improved, especially with regard to quality of sound and image. The difficulties to operate the equipment e.g. to place the overlays correctly on the concept keyboard have to be attented to. The two monitors must be exchanged to one larger monitor as the staff have complained on the small size of the screen. All parts of the equipment have been used in 38 of the 40 telephone calls.

User aspects
The user aspects are based on information from the telephone protocols, observations and interviews with the staff from the day center. Difficulties for the user have been to get access to the right Pictogram symbols, to operate the equipment. The users have had a positive attitude to the videotelephone and showed interest and motivation. They have conducted 40 calls and sent 405 pictures via the tele network. The reason for calling have mainly been to train and test the equipment. They have used total communication and thus combined different modes to communicate. Both participants have, however, used Pictogram symbols. The conversation subjects have been very limited as the participants only had 50 Pictograms each on the concept keyboard. The most frequent conversation subjects are food and activities. In the main study the number of Pictograms will be at least 100. One obvious problem is to chose the "right" symbols for each participant. The participants have had difficulties to understand some of the symbols on the dialling sheet e.g. "the calling telephone".

Staff aspects
The staff aspects are based on information from the telephone protocols and interviews. The videotelephony activity is time-consuming and the staff emphasize that it is important to have it on the daily schedule and to decide how much priority to give to the activity. The staff also stress that it is important to have somebody appointed as responsible for the training. In order to facilitate the activity it is necessary to give the staff education in communication before the start.

The methods used in the minitrial have been useful for this special purpose, but will be too detailed in the ACE. The background descriptions of the participants which have been used in the minitrial will, however, be used together with different types of ratings. In the ACE, individual goals will be set for each of the participants and goal attainment scales will be completed. The preparation of the ACE will start and the experiments will start in September at six day centers with 25 participants with moderate mental retardation.

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VIDEOTELEPHONES FOR PERSONS WITH MODERATE MENTAL RETARDATION

BACKGROUND DESCRIPTION

Person.....**Sex** .....**Age** .....

Housing conditions

Earlier (for persons living in an institutions, please indicate approximate size)

.....
.....
.....
.....
.....
.....
.....
Present.....
.....
.....
.....
.....

Schooling

Class for mentally reetarded children	Number of years.....
Class for severely mentally retarded children	Number of years.....
Other	Number of years.....
None	.....
Schooling finished	Year.....

Main occupation at day activity center

.....
.....
.....
.....

Social contact network

Has contact with: (Tick relevant alternative)

	Daily	Every week	Sporadically
Mother			
Father			
Siblings			
1.			
2.			
3.			
4.			
Relatives			
1.			
2.			
3.			
4.			
5.			
Friends (or staff during leisure time)			
1.			
2.			
3.			
4.			
5.			

Contact person _____

Spare time interests

.....

.....

Degree of mental retardation

.....

Assessed by

.....

Basis for diagnosis (if possible, please indicate which tests have been used and when the assessment has been made)

.....

.....

Additional functional disorder(Please tick)

Additional functional disorder(Please tick)

Visual impairment _____YES____NO

Type of visual impairment.....

Glasses have been prescribed _____YES____NO

Uses glasses daily _____YES____NO

Needs enlarged text _____YES____NO

Hearing impairment _____YES____NO

Type of hearing impairment .....

Hearing aid has been prescribed _____YES____NO

Uses hearing aid _____YES____NO

Motor impairment _____YES____NO

Type of motor impairment .....

Uses mobility aid _____YES____NO

Type(s).....

Epilepsy _____YES____NO

Medication _____YES____NO

Speech impairment _____YES____NO

Medical disorders _____YES____NO

Type.....

Other.....

.....

.....

Gross motor impairment _____YES____NO

Type.....

.....

Comments.....

Fine motor impairment _____YES____NO

Type.....

.....

Comment.....

Pictures

Recognizes objects on pictures _____YES _____NO

Recognizes persons on pictures _____YES _____NO

Recognizes symbols (Bliss, Pictogram) _____YES _____NO

Recognizes digits, letters _____YES _____NO

Uses pictures/symbols for communication _____YES _____NO

Uses pictures to mark his/her environment _____YES _____NO

Communication/language

Is motivated to communication _____YES _____NO

Communicates by means of speech _____YES _____NO

Communicates by means of signs _____YES _____NO

Communicates by menas of pictures/symbols _____YES_____NO

Principal way of communications (please also indicate combinations)

.....

.....

Use of communication aids _____YES _____NO

Type:.....

.....

Initiates communication:

_____always_____often_____sometimes _____ seldom_____ never

Responds to communication:

_____always_____often_____sometimes _____ seldom_____ never

Telephoning before the start of the project

Uses the telephone:

_____daily_____sometimes _____ seldom_____ never

Calls the following persons:

.....

.....

.....

.....

Recognizes telephone voices of

persons close to him/her _____YES _____NO

Recognizes different telephone signals _____YES _____NO

Can make a call by him/her self _____YES _____NO

Can answer the telephone on his/her own _____YES _____NO

Please describe the normal procedure for telephoning:

.....

.....

.....

.....

.....

.....

Please describe an ordinary weekday in the participant's life (normal routines, occupation, contacts etc.)

.....

.....

.....

.....

.....

Thank you for your cooperation. Please send the completed form to:

Jane Brodin
Department of Education
Stockholm University
S-106 91 STOCKHOLM

Appendix 2

TRANSMISSION OF MOVING PICTURES

PEOPLE WITH MODERATE MENTAL RETARDATION **A-Form**

PROTOCOL FOR USE OF TELEPHONE

Day activity center/Station..... Date.....

Incoming.....Outgoing..... Filled out by .....

---

1. Dialogue partner

2. Initiator

3. Reason for the call

4. The following parts of the equipment were used (fill out x after the alternative)

Videomonitor..... Pictogram monitor..... Document camera .....

Concept key board..... Personal Mini caller ..... Printer .....

5. Conversation Topics

6. Fill out the expressions describing the participants' attitudes to use the telephone:

Looks happy/seems to enjoy	O
Seems motivated	O
Takes initiatives	O
Shows expectation/exitement (e.g.strengthens body/ becomes active)	O
Shows interest	O
Shows no interest/looks bored	O
Looks afraid/looks anxious	O
Looks angry/upset	O
The task is difficult/laborious	O
Experiences the situation as heavy demands	O
Seems unconcerned	O
Other	O

Comments

7. Please indicate what pictures were transmitted via the tele network?

8. The participants mode of communication when calling (please indicate all)

Spoken language	O
Picture communication	O
Pictogram symbols	O
Other pictures	O
Real objects	O

Comments (please indicate which mode of communication was most frequently used)

9. The quality of the picture/monitor was during the telephone call

Very good O Good O Satisfying O Bad O Very bad O

10. The quality of the transmission of sound was during the telephone call

Very good O Good O Satisfying O Bad O Very bad O

11. Did the participant have any difficulties to place the pictures correctly on the document camera?

Yes O No O

If yes, please indicate in which way

12. Did the participant have difficulties to put on and change the overlay on the concept key board during the telephone call?

Yes O No O No answser 0

If yes, please indicate in which way

13. Please indicate how many pictures were transmitted in different ways

How many pictures were transmitted via the concept key board .....

How many pictures were transmitted via the document camera .....

How many pictures were transmitted via the picture telephone .....

Comments

Appendix 3.
B - Form

To be filled out at two occasions *(after one and after three weeks´ use of the telephone)*

B1. How do you consider the time interval when calling (i.e. does the searching/calling up take too long time)

Yes O No O

If yes, how do you estimate the importance of this for the participant

Does not matter O Acceptable O Has great importance O

Comments

B2. The size of the screen is

Too small O Satisfying O Too big O

Comments

B3. Has the concept key board functioned satisfying during the minitrial

Yes O No O

If no, please indicate what the problems have been

B4. Do you have the opinion that the participants have understood the symbols when making a call (e.g. the picture of a "ringing" telephone which is shown on the screen)

Yes O No O

If no, please indicate what the problems have been

B5. Has there been a schedule made out for the participants of using the videotelephone

Yes O No O

B6. Do you consider it as important to have a special schedule made out for this purpose

Yes O No O

B7. How many persons from the staff has in one way or another been involved with the telephoning with the two participants (please indicate the number of staff involved)

.....

B8. Does any of the staff at the day acitivity center have the main responsibility for the project acitivity

Yes O No O

Comments

B9. Does any of the staff take the main responsibility for the use of the telephone for each participant

Yes O No O

Comments

B10. How long a time has totally been spent by the staff during the first week to learn how the equipment works and to plan the activity for the participants

About.....hours

B11. How long a time for the staff who works with the project has totally been used for conducting the calls (including all moments - also time for preparation). This does *not* include the time when the staff is working with their own learing/training.

Week 1 .....
Week 2 .....
Week 3 .....

Comments

B12. What is the attitudes of the staff towards the project (fill out the adequate alternatives)

Interesting/positive	O
Time consuming	O
Difficult to find time for telephoning	O
Demanding/Demands for heavy efficiency	O
Laborious to fill out the forms	O

Please comment on separate sheet if needed.

Appendix 4.

List of Technical Equipment

Item	Supplier, Model
* PC 386SX/25 MHz	DEC station 320
* MS-DOS 5.0	Microsoft
* Windows 3.1	Microsoft
* Serial Port Expansion Board	Digichannel PC/8 DigiBoard
* Codec	Tandberg Vision Model 15
* Codec Keyboard Interface	Daltek 320037-001
* Television Monitor	Handic 2000
* Concept Keyboard	Daltek 320037-002
* Main Camera	Vatek CC810P
* Document Camera	Daltek 320045-001
* Laser Printer	Canon LBP-4 PLUS
* Paging System	Swedish Telecom "Minicall" service

STOCKHOLM UNIVERSITY
Department of Education
S-106 91 STOCKHOLM
Sweden
Tel. +46 8 163147
Fax +46 8 158354

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